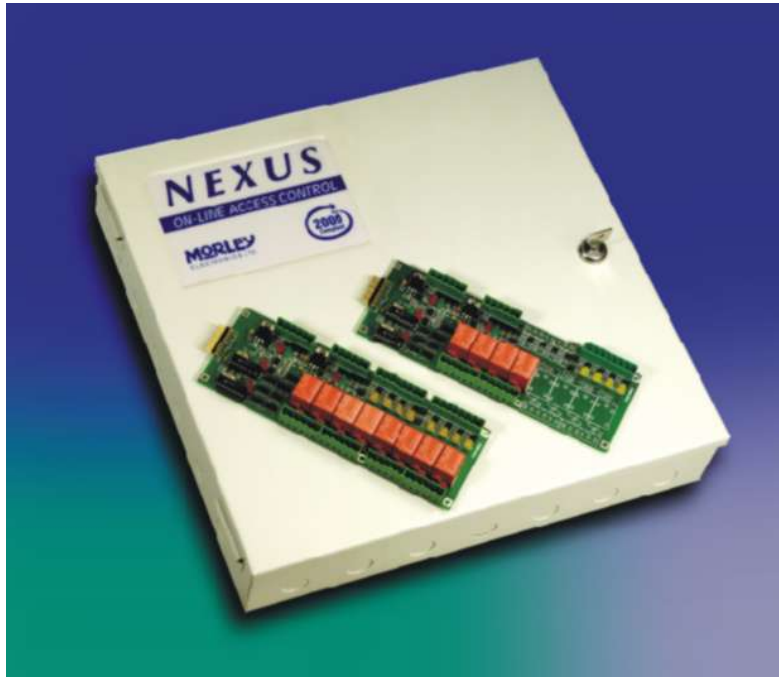


NEXUS Modular Access Control

MORLEY
E.L.E.C.T.R.O.N.I.C.S. L.T.D



NEXUS MODULAR ACCESS CONTROLLER INSTALLATION MANUAL

NEXUS Modular Access Control

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Note:

Nexus controllers are designed to operate with and be administered from, Morley's Visikey Access Management software package and must be connected to a PC running Visikey at all times.

About this Manual

This manual is intended to aid engineers in the installation and testing of the NEXUS range of access controllers. Nexus controllers form only part of the overall security access system so it is important for the installer to have a full understanding of the whole system.

The following chapters explain how to install, commission and test Nexus controllers within the access control system. You should ensure that you have copies of all relevant equipment documentation before proceeding with this manual.

Nexus Controllers

The Nexus controller is a fully modular controller, which provides a fully scalable access control solution. At the heart of the controller is a pipelined 16-bit microprocessor, designed to give high system performance, even in the most demanding installations. The processor not only carries out the on-board control functions but also stores all system user details and system configuration database in each controller.

The controller comprises a main system processor board, housed in a lockable steel box (Part no.101007) into which up to 4 dual reader modules (DRM) can be connected. The standard dual reader module (Part no. 101008) accommodates two readers together with 4 clean contact inputs and 4 changeover relay outputs. An alternate DRM (Part no. 101009) also has two reader inputs, but offers increased input and output capability, with 8 CCM inputs (clean contact monitor) and 8 c/o relay outputs on each DRM, thereby enabling each Nexus to control up to eight readers with 32 monitored inputs and 32 relay outputs.

Each Nexus controller stores up to 23,000 users data. If necessary, this can be expanded to 65,000-user capacity. Nexus also has an on-board transaction database. This database is needed in case the controller loses communications with other controllers and the PC. Each reader input will store 4,000 events, ready to be uploaded to the PC once communications have been restored.

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Changes to the system configuration, such as new users added, are automatically uploaded to all Nexus controllers via the Visikey software package.

Visikey Management Software

Visikey is a powerful and flexible software package operating on a wide range of Windows platforms.

Visikey is used to initially instruct the Nexus controllers about their configuration, about users connected and about how the controller should behave under operational conditions.

Once configured, the software receives all transaction data from each controller. The data is used to update the transaction screen, carry out inter-controller logic functions and to update the system database. The system database is a store of all events, including operators logged on the system, transactions, whether they were accepted or rejected, alarms, doors forced open, left open or timed events, to name but a very few. For further details of the capabilities of Visikey software, please see the Visikey product manual.

Visikey is compliant with a number of operating platforms including Windows 95, 98, 2000, NT and ME.

Forward/Backward System Compatibility

Nexus controllers are fully compatible with existing Visikey (ACS) systems and can be installed alongside existing Morley ISC4 controllers. Nexus will also run the advanced communications networks sometimes required, such as IEC or Echelon protocols. When retrofitting existing installations it is important to ensure that Visikey version 2.40 or later is installed for correct operation of the Nexus controllers.

Decisions on the structure of system communications networks can be an exact science. In almost all cases, Morley already includes the network provisions within our standard parts list. The installer therefore has only to install the relevant modules and inter-connection cables to complete the network structure. However, if you are unsure of the networking requirements or would like further information; please do not hesitate to contact Morley Electronics.

Door Readers

Door readers form an important part of any access control system and a multitude of reader types are available on the market. It is important to use the correct type of reader for the environment to which they will be installed

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and the installer should give this due consideration at the design and installation stages.

When installing into environments where there is a likelihood of card contamination it is advisable to select a contactless technology such as RFID (Radio Frequency Identification) 'proximity'. Contactless technologies also have the advantage of requiring less 'hands on' maintenance.

When considering door readers for external operation ensure that readers with suitable IP ratings, resistance to abuse and operational temperature ranges are chosen. Morley offers a complete range of readers for all applications and user requirements; including vandal resistant and door entry panel mount readers and can be contacted for further information and advice.

When installing proximity type readers to both sides of a door it is sometimes desirable to mount the readers back to back. In such cases ensure that the two readers will not interfere with each other. This is most important when installing APB systems, as on partition walls it is possible for both readers to see the presented token, thereby causing a potential system ABP violation.

In the event that installed readers do interfere with each other it is sometimes possible to prevent cross reading by offsetting one reader, this very much depends on the structure material and layout and is therefore a trial and error process of moving and re-testing, until a satisfactory result is achieved.

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Nexus System Overview

The simplest form of Nexus access control system consists of four components:

- The PC administration system,
- The Nexus controller,
- A door reader
- And an electronic lock.

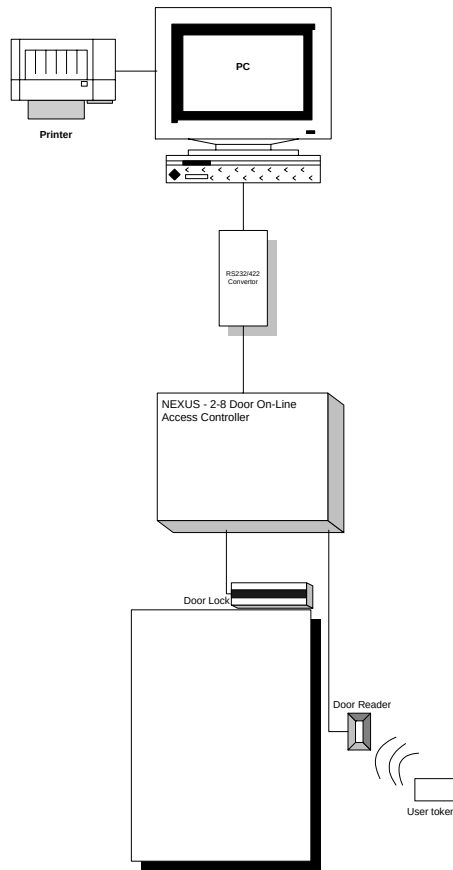


Fig. 1 A simple Nexus 1 door system

When a user presents an access token to the reader, the unique encoded token number is sent to the Nexus controller via the reader, which is connected to the reader input on the DRM. The controller then processes this number, with checks being carried out against the database held in the controller. These checks are the configuration and access rights for the user and may include the following considerations:

- Does the card number on the card match a card in the database?

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- Is the card valid for the area to which the reader is assigned?
- Is the card valid for the time of presentation?
- Is the card disabled?
- Does the card have the correct APB level (APB readers only)?

If any of these conditions are not met the user will not be granted access through the door.

A PC administers the databases held in each of the controllers in the system controller network. Morley's Visikey software package has been designed by Morley specifically for this task and has, over several years of use and development, become one of the most powerful and flexible packages of its kind available throughout the access control industry.

Although administration of the controller database is carried out using a PC, the controllers are fully autonomous, operating in a distributed intelligence process. Should communications be lost with the PC, the controller will continue to process card transactions and store them in its internal history database which when communications are restored will be uploaded to the PC. This ensures that no card transactions or alarm conditions are lost during system failure.

Both the controller database and real time clock are maintained during power outages ensuring unbroken correct controller operation when power is restored.

If the entry conditions are met, Nexus grants access by releasing the door lock via the output relay. If the user is inside and wants to get out using a request to exit button, the button is pressed and the change of state of the button contacts is acknowledged by the CCM input on the DRM. The controller then releases the door lock via the output relay.

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Nexus Parts & Operation

Nexus Enclosure and Processor Module

Nexus is a modular access control system. The illustration below shows each of the controller elements.

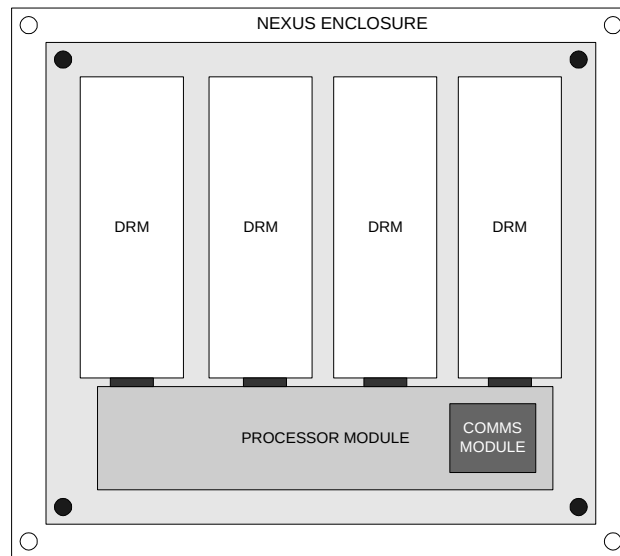


Fig. 2 Illustration of Nexus Controller and modules

Each Nexus controller has a common part number for the controller enclosure (101007), which also includes the processor module.

Nexus Enclosure details

- Dimensions: 360H X 375W X 75D all mm.
- Painted mild steel box with key lockable door, fully hinged on the left side.
- 26 x 20mm cable (knockout) entries, 7 along top and bottom, 6 down each side.
- Removable electronic assembly back plane, holds Processor Module, DRM's & Comms Module (Comms Module fits on to Processor Module)

Nexus Terminals & LED's

Nexus is designed with the engineer in mind. Therefore every reader input, contact input, relay output and communications connection is backed by visual LED confirmation of operation.

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Connections to reader inputs, contact inputs and relay outputs are carried out using plug in terminal blocks for greater control and ease of installation and maintenance.

Nexus Power

Power for the controller is provided via a separate 12Vdc power supply; two separate power inputs are provided on the motherboard. These being 'controller' and 'auxiliary' power supplies. The controller supply provides power for the controller logic circuitry whilst the auxiliary supply provides power for readers and relays both input are fused and connection of both supplies to one suitable rated power supply is acceptable.

Power supplies

Nexus does not carry on board transformer and battery charging facilities. This is provided by external psu's, which must be suitably rated for both the power requirements of the controller as well as the readers connected to the controller.

The section 'Applying Power' (page 41), discusses power requirements in greater detail, as well as offering guidance on the estimation of system power requirements.

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Dual Reader Module (DRM)

Dual reader modules are used to connect readers into the Nexus controllers. Up to 4 dual reader modules can be 'plugged' into each Nexus controller, giving a total reader capacity of 8 per controller. Reader modules may be added at any stage to the controller should system expansion be required during the life of the system.

Nexus dual reader modules support the most commonly used unidirectional reader interfaces.

These include,

- Watermark
- ABA Track 2
- Wiegand
- PAC

Which covers the majority of reader technologies in use. Many other reader and user token formats are factory configurable on request, with numerous variations to the most common formats available as standard. For details and/or specific reader technology queries, contact Morley Electronics.

Interface to the reader is provided via a 6 way removable terminal block.

The reader module provides selectable 12Vdc and 5Vdc power, which is over-current, protected. It should be noted that the over-current protection, once activated, can only be reset by removal of power to the Auxiliary supply input. Reader supply protection is on a reader input-by-reader input basis and does prevent proper operation of the remaining readers connected to the controller.

Readers connected do not have to be of the same operating technology; Nexus will happily run different reader technologies on each reader input.

Other forms of reader input are also catered for including smart readers, biometric readers, as well as keypads.

When designing a Nexus access installation, consideration may be given to future expansion by leaving spare DRM slots in controllers. When the time comes to expand the system, add another DRM and the control element is complete.

DRM's also carry clean contact inputs and relay contact outputs, which are used to link and control other facets of access control installations, such as request to exit buttons.

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Inputs - Clean Contact Monitors (CCM)

The clean contact monitors are voltage free inputs, which look for a remote contact to change over and indicate a change in state, for instance a request to exit button.

The input change is programmed to elicit the required response from the controller, for instance to release a door lock, via the output relay.

Note that connection to any type of device other than that, for which the contact is specified, may lead to system malfunction and potentially permanent damage to the controller.

Connection to the CCM should be carried out as illustrated below.

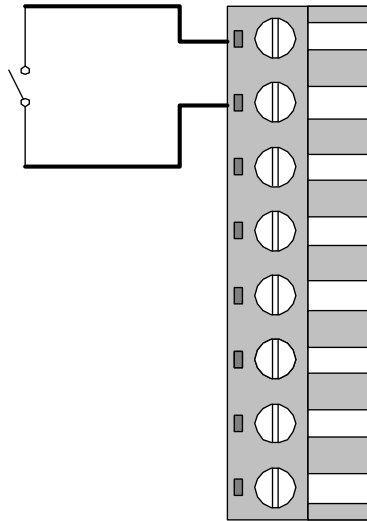


Fig. 3 Clean Contact Inputs to Nexus DRM

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Outputs - Relays

DRM onboard relay contacts are single pole changeover with both N/C and N/O contacts available for use.

Note that no more than 24Vdc should be switched across any relay contact as this may cause permanent damage to the reader module.

When switching inductive loads it is important that adequate transient suppression is installed.

Morley includes in the Nexus kit, Metal Oxide Varistors (MOV) that are used to prevent back e.m.f. These effects are also known, as 'spikes' and the MOV will help avoid damage to the Nexus controller. The MOV suppression kits included with the controller for lock suppression should be installed as close to the lock as possible.

When switching other types of inductive load ensure that suitable suppression is employed. See each device manufacturers' information to ascertain possible effects and to select the appropriate form of protection.

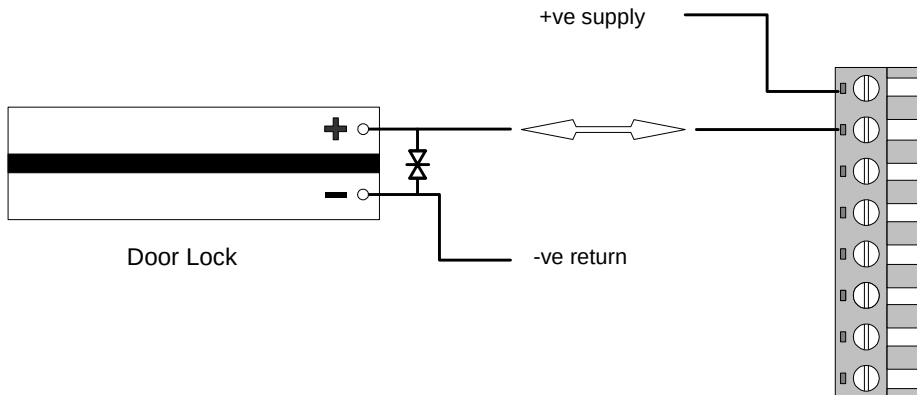


Fig. 4 Diagram showing MOV protection located at door lock terminals

Note: Nexus relay contact ratings are subject to relay specification and may change. If you have contact rating issues, please contact Morley for further advice.

Input/Output Protection

Both inputs and outputs are fully protected against over voltage damage, but installers should always check that only the correctly rated power is applied. As stated earlier, damage can be caused through the connection of over voltage or some other inappropriate power form. For any further details or advice, contact Morley Electronics.

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Nexus Communications

Nexus controllers relate with the outside world through communications modules. The communications module links the Nexus controller with other controllers, with modems, networks, other types of networking links, or directly with the administrating PC.

Networked Nexus

Multiple Nexus controllers can be connected singularly or in networks. Networking methods are varied and can include the following (not exhaustive) list.

- RS232
- RS422/485
- Echelon free topologies
- Dedicated 'Lease Line' modems
- Dial-Up Modem
- LAN/Network connections
- CAT5 networking
- Micro-Wave links
- Radio links
- Mobile GSM links
- Infra Red Transceivers
- Fibre Optic networks

RS232 Networks

In a single controller application, the installer may connect the Nexus directly to the RS232 input port of a PC through the use of a Nexus RS232 communications module (102002). This part is connected to the processor board and offers direct connection to the PC.

Note however, that the connection length should not exceed 11m.

Additional controllers will necessitate changing the RS232 connection to an alternate network structure, such as RS485 or Echelon.

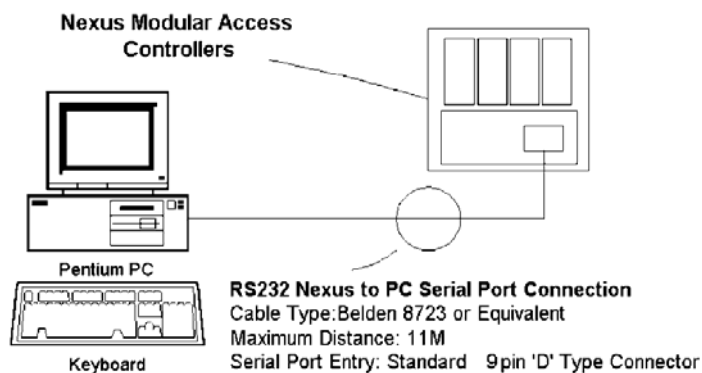


Fig. 5 RS232 Network Schematic

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RS485 Networks

The most common communications method is the RS485 loop. With a maximum of 32 controllers per RS485 loop and each loop having a network length of 1.2Km, RS485 is more than adequate for most applications. For applications where more than one loop is required it is easy to add another RS485 loop and a further 32 controllers, up to a maximum of four loops, as shown below.

RS485 modules (102001) are mounted on to the Nexus processor board in each Nexus enclosure.

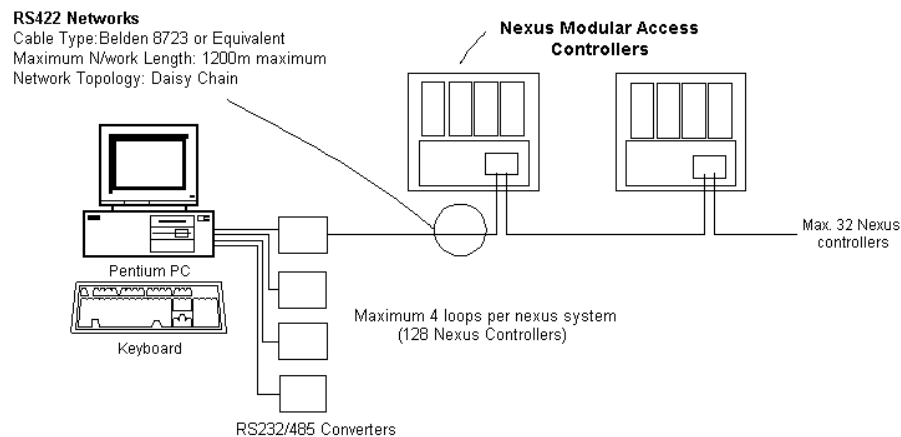


Fig. 6 RS485 Network Schematic

RS232/485 Converters

Nexus networks are connected to the administration PC via converters. These converters (104008) allow the RS485 communications from the Nexus controllers to be converted to RS232, which can be connected directly to a serial port in the PC. This is by far the easiest and safest way to connect the network to the administration PC.

The converters are sent from Morley complete with housings and RS232 connection cables to the PC. Locate the converter as close as possible to the PC.

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Nexus systems cable specification and requirements

From	To	Cable	Max Distance	Comments
PC	RS232/485 Converter	Belden 8723 or Equiv.	15 m	Cable supplied with 104008
RS232/485 Converter	Nexus Controller	Belden 8723 or Equiv.	Max total network length 1200m	Daisy chain between controllers. Maximum of 32 Nexus controllers per RS232/485 converter loop
Nexus Controller	Reader / Indicators/ Release	20AWG	125m	See also, reader specifications and guidelines
Nexus Controller	Monitored Inputs	20AWG	250m	4 or 8 clean contact monitors per Module.
Nexus Controller	Relay outputs	20AWG	200m	4 or 8 output relays. 4A @ 12v or 24v

Table 1 – Nexus Cable Specifications

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Morley Free Topology Networks

Using Echelon® Link Transceivers

The Morley Free Topology Twisted pair module provides a simple, cost effective method of controller interconnection. Use of single pair polarity insensitive cable is employed in a free or bus topology. The use of free topology wiring allows the installer to wire in star, loop or bus architectures thereby potentially reducing installation time and costs by allowing the most expedient cabling method to be used.

The Morley Free Topology interface is also fully compatible with Echelon's Link Power Transceiver.

A twisted pair channel can consist of multiple segments separated by physical layer repeaters. A physical layer repeater allows a Twisted Pair network to inexpensively grow accepting many more controllers or longer cable distances than would be possible on a single segment network.

Installation

Unlike bus wiring designs such as RS485, the Echelon® free topology wiring scheme supports star, loop and/or bus wiring. This method of wiring has many advantages, firstly the installer is free to select the method of wiring that best suits the installation, reducing the need for system planning and allowing last minute system changes. Secondly retrofits to existing Echelon® based installations can be carried out with minimal wiring changes.

Supported Topologies

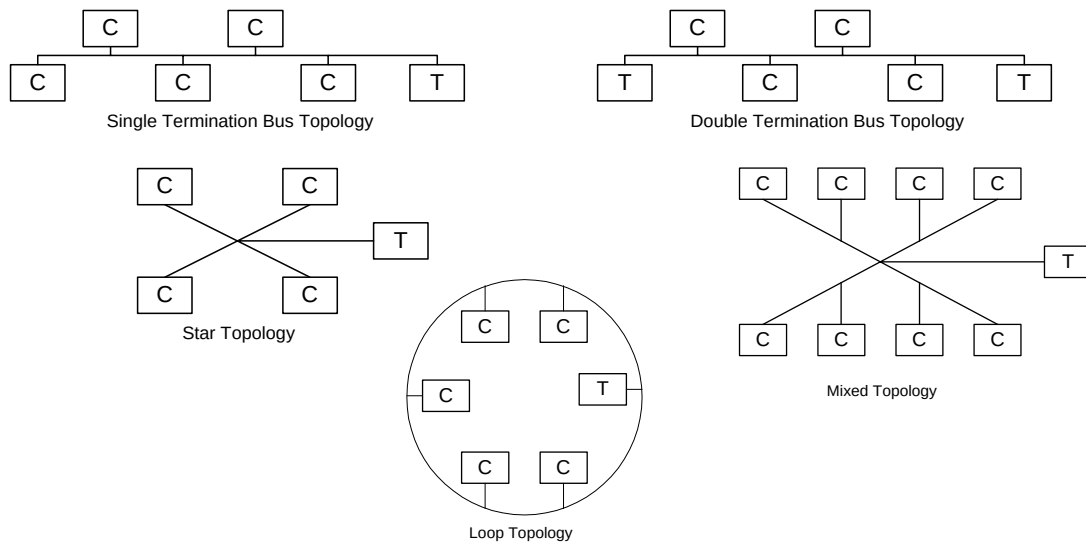


Fig. 7 Echelon Topologies

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Morley Free Topology Repeaters

In the event that limits on physical cable length or number of nodes are exceeded, a physical layer repeater can be used to interconnect 2 or more network segments. The Morley physical layer repeater can interconnect 2 to 6 network segments. The following drawing is a typical channel illustration utilizing a physical layer repeater.

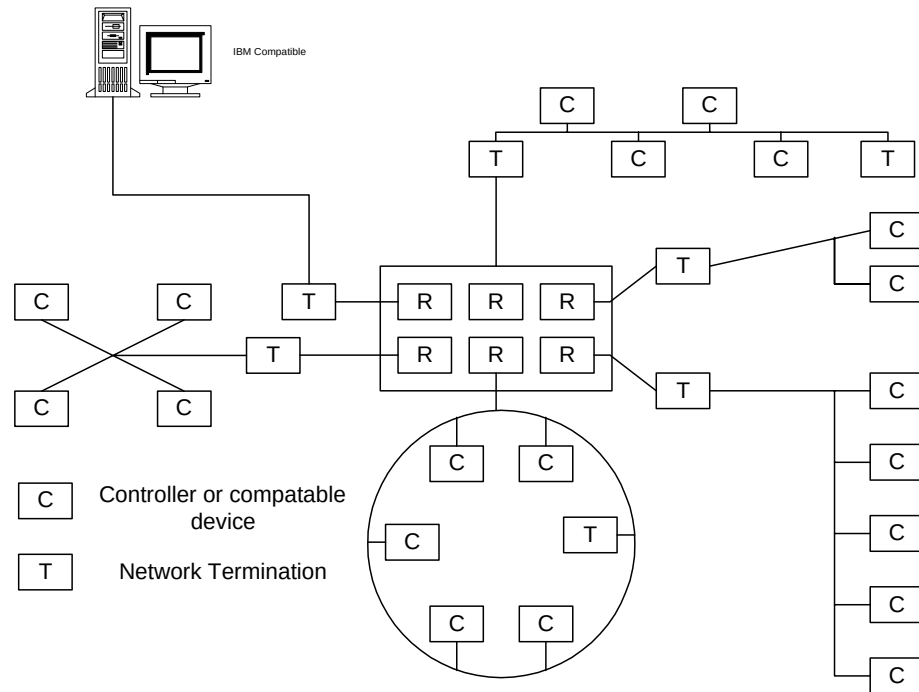


Fig. 8 Typical system topology for Echelon Transceiver Networks

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Transmission Specifications for Morley Free Topology Networks

	Maximum Bus Length	Units
Belden 85102	2700	Meters
Belden 8471	2700	
Level IV, 22AWG	1400	
JY (St) Y 2x2x0.8	900	
TIA Category 5	900	

Table 2 Doubly-terminated Bus Topology Specification

A doubly - terminated bus may have additional 3 meter stubs from the bus to each node.

	Maximum node-to-node distance	Maximum Total wire length	Units
Belden 85102	500	500	Meters
Belden 8471	400	500	
Level IV, 22AWG	400	500	
JY (St) Y 2x2x0.8	320	500	
TIA Category 5	250	450	

Table 3 Free Topology Specifications

The free topology transmission specification includes two components, which must both be met for proper system operation. The distance from each transceiver to all other transceivers and to the termination must not exceed the maximum node-to-node distance. The maximum total wire length is total amount of connected cable per segment.

The Maximum number of Morley Electronics access controllers supported on any Echelon ® channel is 63.

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Installation and Testing

Unpacking Contents

All Nexus controllers are tested prior to packing. When you receive a controller, you should be receiving the complete unit to meet the requirements for your specification, so please locate the controller key, which should be attached to the side of the controller. Open the controller housing and ensure the following parts are present.

- 1 Nexus Installation Manual
- 2 Cable Ties
- 8 MOV suppression components for connection to lock devices
- 1 Nexus chassis plate with controller card, fixed to the enclosure
- 2 Reader Modules, as requested in your order
- 3 Communications Module of a type (RS232/485, etc. as requested)

Please note that all wiring connections to Nexus are made via plug-in terminal blocks to aid installation and commissioning. You should ensure that all terminal blocks are present.

Installing the Controller

Installers should remove the Nexus back plate, complete with processor board and any DRM's, from the enclosure and store until installation cabling is complete.

Nexus controller boxes should be oriented correctly, that is with the door hinge on the left. Ensure the box is positioned in a clean, dry area, free as possible from dust and any other contaminants. Ensure also that the controller and the system cabling is kept away from any medium or high voltage cabling, system wiring for large machines likely to create electrical spikes or interference with reader operation and Nexus supplies.

The Nexus enclosure has 4 fixing points, one at each corner. Note that the controller should be flat mounted against a fixed, dry surface.

Nexus controllers do not carry external status indication and can be placed in risers, ceiling voids, etc. However, installers should ensure that the controller remains accessible for both wiring and future maintenance.

Having located the controller enclosure, ensure cable tails are of sufficient length to keep Nexus wiring neat and tidy, this can help enormously during commissioning and any future modifications. Once the cabling is in place, re-fit the Nexus back plate using the four, machined nuts fixed to the four back plate studs in the Nexus enclosure.

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Nexus Controller Modules Layout

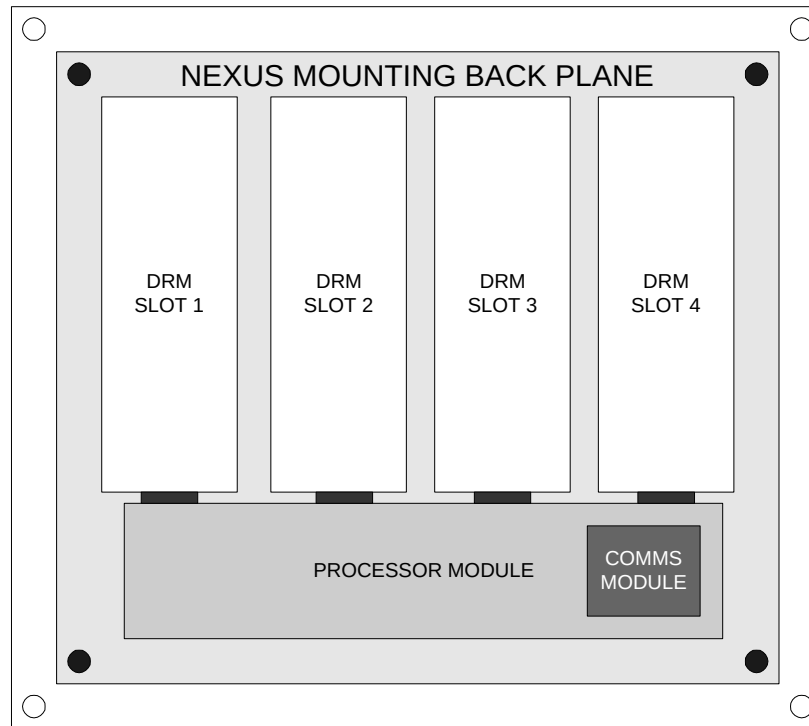


Fig. 9 Nexus Controller Modules Layout

The diagram above shows the overall controller layout with all four modules connected.

Dual reader modules do not have to be installed in sequential order that is in slots 1-4. However Nexus has been designed to follow sequential slot use, in order to make installation and commissioning a much more simple task.

This is achieved by following a set installation pattern, the form of which you can see from the controller diagram above.

Each of the DRM's has a designated reference in the controller, as do the reader and contact inputs and the relay outputs. This organized approach also allows intermediate modules to be removed from a controller without affecting the remaining installed modules, which can be very useful when relocating readers on an existing system.

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Nexus Visual Indications & Controls

Processor Module

Controller status indication is given on the processor module for the each of the following conditions.

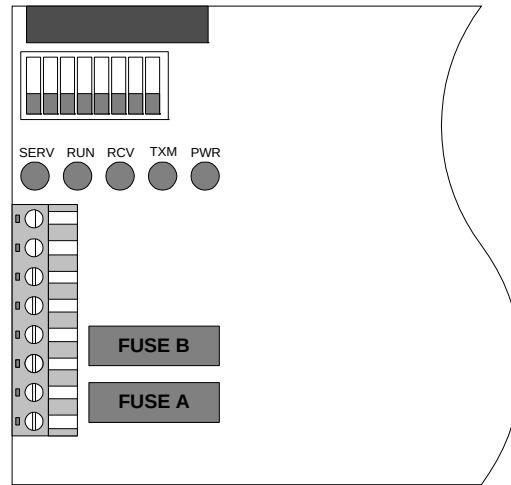


Fig. 10 Diagram showing indicator section of Nexus processor module

Where,

- SERV - Echelon service pin indicator is a steady Green LED
- RUN - Controller running is a Yellow LED cycling at 1-second duration
- RCV - Data reception in progress is a flashing Red LED
- TXM - Data transmission in progress is a flashing Green LED
- PWR - Power present when illuminated with a steady Green LED

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Dual Reader Modules

Nexus DRM's have indication of each of the following DRM conditions.

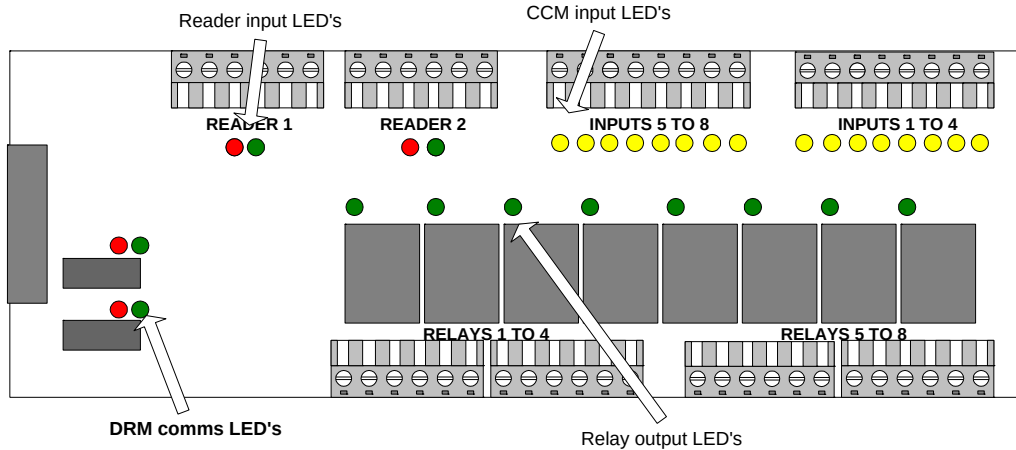


Fig. 11 Nexus Dual Reader Module LED Status Indication

Where,

Reader inputs

- Green LED - Steady Green indicates card read and accepted
- Red LED - Steady Red indicates card read and rejected
- Flashing Red indicates card read but data is not recognised

Contact (CCM) inputs

- Yellow LED - Steady Yellow indicates input activated

Relay outputs

- Green LED - Steady Green indicates output activated

Comms LED's

- Green LED - Flashing Green for Transmit to processor module
- Red LED - Flashing Red for Receive from processor module

Communications Modules

Some communications modules carry visual indication of module status, dependent upon the type used. All comms modules are designed to operate without the need for installer modifications. For further details on particular types used and for status checks, please call Morley Electronics.

Nexus Controller Fuses

Two fuses located on the processor module provide power protection for the Nexus controller.

Fuse (A) 1A 20mm anti-surge, protects controller logic circuits during over-current and over voltage conditions.

Fuse (B) 3.15A 20mm anti-surge, protects reader and relay supplies. Note that reader supplies are individually over-current protected by resettable

NEXUS Modular Access Control

thermal fuses. This fuse maintains power to all serviceable readers under reader fault conditions.

Controller Addressing

A Bank of 8 DIP switches for addressing the controller are located on the motherboard.

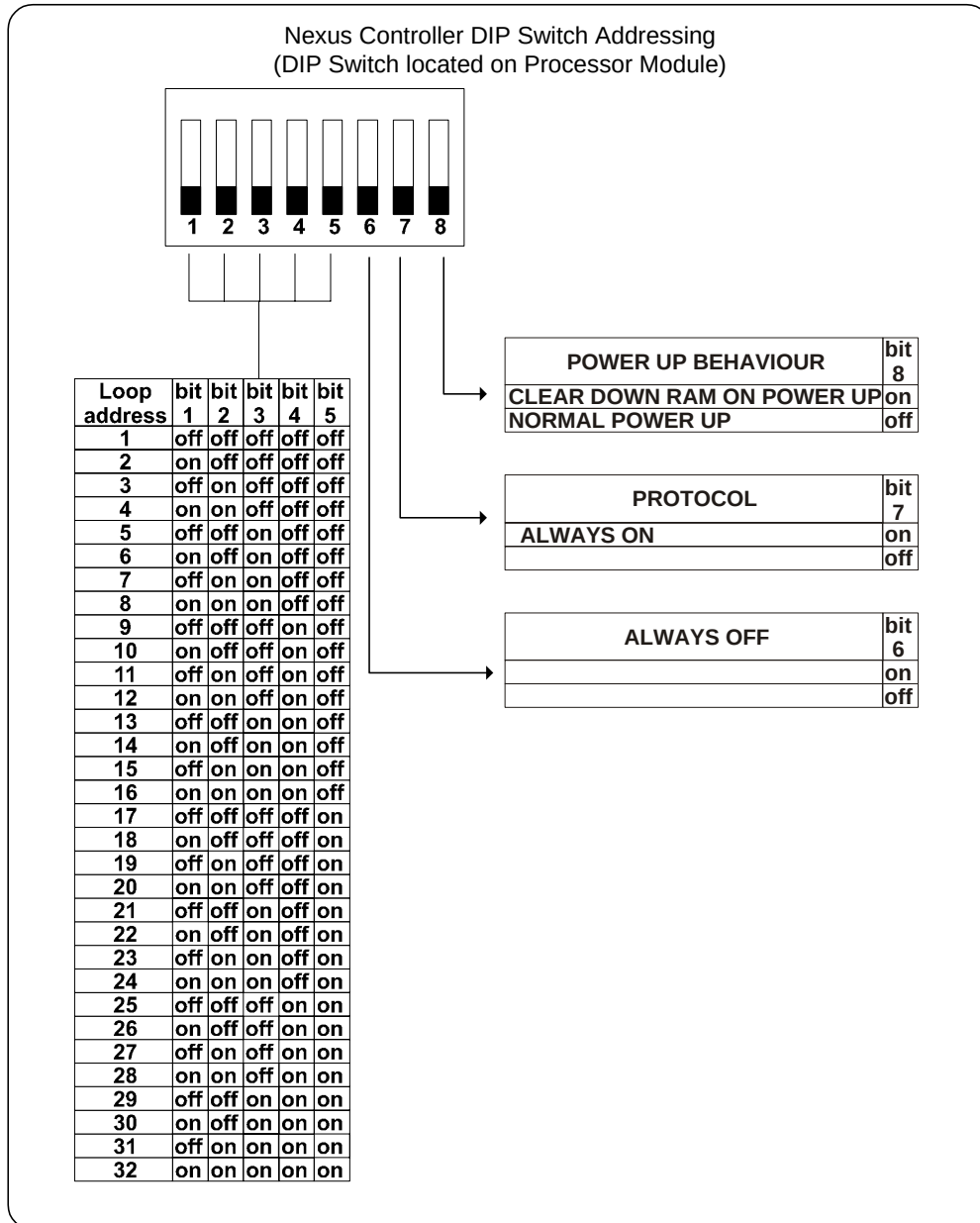


Fig 12. Nexus Processor Module Dipswitch Settings

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DIP Switch Programming

As part of the commissioning process, Nexus controllers are addressed through the DIPswitches shown in the diagram on the previous page. The Dipswitches are located on the Processor Module, adjacent to the controller status LED's

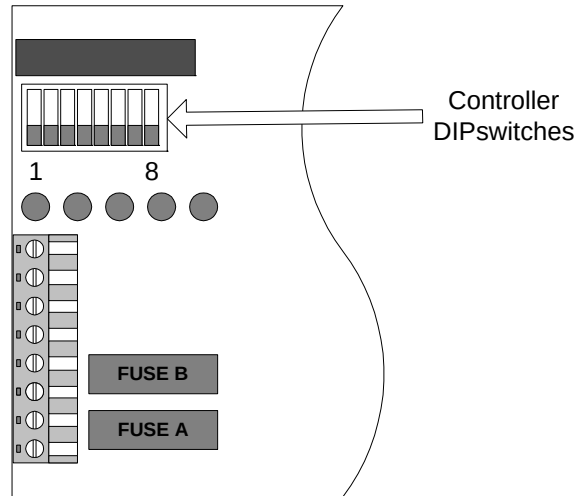


Fig 13. Dipswitch location

Switches 1-5

The first five switches in the block of eight set the address of the Nexus controller, where the number corresponds to the controller address on each Nexus 'loop' – remember that controllers can be connected to different network loops - with up to 4 RS485 loops. Nexus allows a maximum of 32 controllers per RS485 loop.

Echelon communications networks offer different loop structure, but controllers are still addressed using the same bank of Dipswitches. For further specific details regarding the installation and commissioning of Echelon based systems, contact Morley Electronics.

Switches 6-8

Switch 6 is always set to the 'off' position.

Switch 7 is always set to the 'on' position.

Switch 8 is set to the 'on' position during installation and commissioning, but set to the 'off' position once the Nexus system has been commissioned.

Note:

Switch 8 is used to clear the controller RAM on power up. As controllers are tested at Morley prior to being sent out, setting the switch to 'off' prior to being commissioned, would cause the controller to attempt to re-use the test data, thereby causing controller malfunction.

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Reader Module Layout

Each DRM has two reader inputs, together with CCM (Clean Contact Monitor) inputs and relay outputs. The diagram below illustrates the layout of a DRM as viewed from the front, with the plug-in pins facing downward.

Note that the diagram shows a fully populated DRM with 8 inputs and 8 outputs (part no. 101009). The more commonly used 101008 DRM has 4 inputs and 4 relay outputs. Either type of DRM may be used and the two types can be mixed on the same controller.

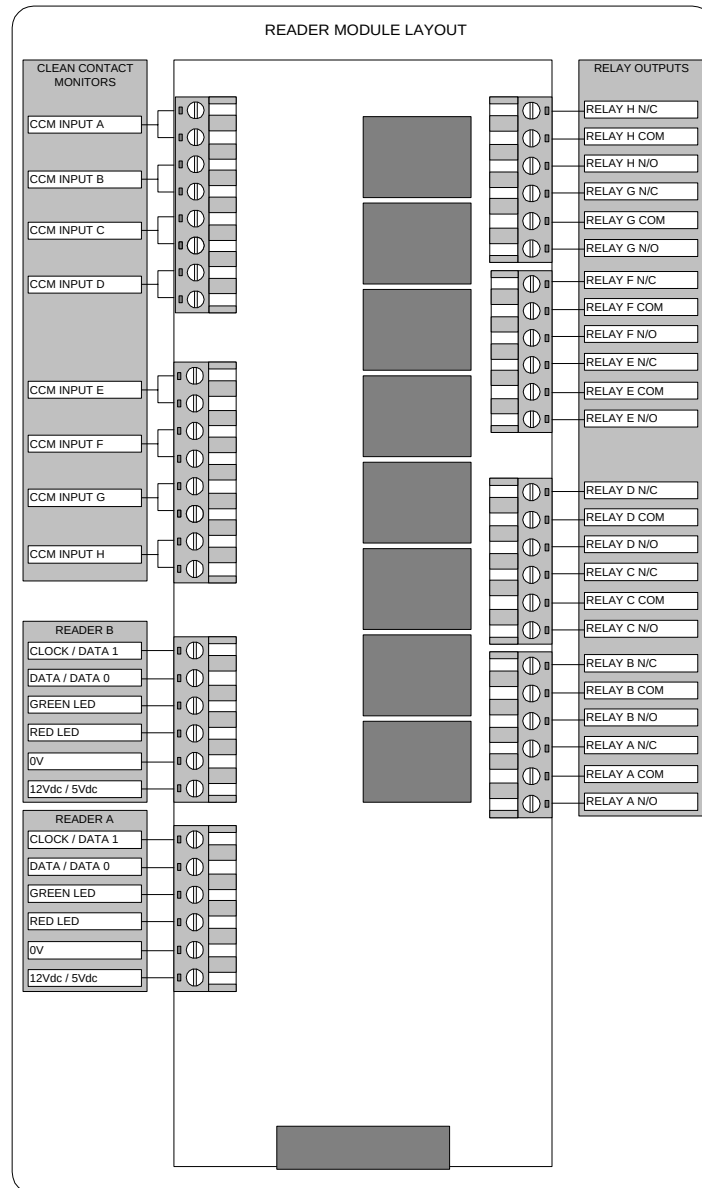


Fig 14. DRM Input/Output Layout

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Reader, contact input and relay output assignments

The table below shows the assignment of reader input, contact inputs and relay outputs as they are given for a fully populated Nexus controller. The heading on each of the shaded columns represents the dual reader module slot number, 1-4, whilst the row titles indicate the assigned numbers for each of the reader inputs, contact inputs and relay outputs.

Assigning connections allows Nexus to be easily installed and commissioned. It also makes installation an easier format to follow. For example reader port A becomes reader 5, when connected to dual reader module (DRM) slot 3.

Reader Slots	DRM Slot 1	DRM Slot 2	DRM Slot 3	DRM Slot 4
Reader A	Reader 1	Reader 3	Reader 5	Reader 7
Reader B	Reader 2	Reader 4	Reader 6	Reader 8
Clean Contact Inputs				
CCM Input A	CCM Input 1	CCM Input 9	CCM Input 17	CCM Input 25
CCM Input B	CCM Input 2	CCM Input 10	CCM Input 18	CCM Input 26
CCM Input C	CCM Input 3	CCM Input 11	CCM Input 19	CCM Input 27
CCM Input D	CCM Input 4	CCM Input 12	CCM Input 20	CCM Input 28
CCM Input E	CCM Input 5	CCM Input 13	CCM Input 21	CCM Input 29
CCM Input F	CCM Input 6	CCM Input 14	CCM Input 22	CCM Input 30
CCM Input G	CCM Input 7	CCM Input 15	CCM Input 23	CCM Input 31
CCM Input H	CCM Input 8	CCM Input 16	CCM Input 24	CCM Input 32
Relay Outputs				
Relay Output A	Relay Output 1	Relay Output 9	Relay Output 17	Relay Output 25
Relay Output B	Relay Output 2	Relay Output 10	Relay Output 18	Relay Output 26
Relay Output C	Relay Output 3	Relay Output 11	Relay Output 19	Relay Output 27
Relay Output D	Relay Output 4	Relay Output 12	Relay Output 20	Relay Output 28
Relay Output E	Relay Output 5	Relay Output 13	Relay Output 21	Relay Output 29
Relay Output F	Relay Output 6	Relay Output 14	Relay Output 22	Relay Output 30
Relay Output G	Relay Output 7	Relay Output 15	Relay Output 23	Relay Output 31
Relay Output H	Relay Output 8	Relay Output 16	Relay Output 24	Relay Output 32

Table 4 DRM Input & Output Configuration Options

Default Assignments and Installer Connections

To further ease programming and commissioning, Morley has included a set of default assignments, which correspond with the most often-used configuration settings for Nexus control systems.

The preparation of the default configuration has been guided through our experiences over countless security access control systems and system configurations, to speed up the installation and commissioning process.

However, this does not mean that Nexus assignments are fixed and rigid. Manual setting and re-setting of input and output assignments through logic programming (via Morley Visikey software) ensures that Nexus remains flexible to site and applications requirements.

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Reader Slots	Module Slot1	Module Slot 2	Module Slot 3	Module Slot 4
Reader A	Reader 1	Reader 3	Reader 5	Reader 7
Reader B	Reader 2	Reader 4	Reader 6	Reader 8
Clean Contact Inputs				
CCM Input A	Door 1 REM	Door 3 REM	Door 5 REM	Door 7 REM
CCM Input B	Door 1 Monitor	Door 3 Monitor	Door 5 Monitor	Door 7 Monitor
CCM Input C	Door 2 REM	Door 4 REM	Door 6 REM	Door 8 REM
CCM Input D	Door 2 Monitor	Door 4 Monitor	Door 6 Monitor	Door 8 Monitor
CCM Input E				
CCM Input F				
CCM Input G				
CCM Input H				
Relay Outputs				
Relay Output A	Door 1 Release	Door 3 Release	Door 5 Release	Door 7 Release
Relay Output B				
Relay Output C	Door 2 Release	Door 4 Release	Door 6 Release	Door 8 Release
Relay Output D				
Relay Output E				
Relay Output F				
Relay Output G				
Relay Output H				

Table 5 DRM Default reader, input and relay output assignments

The default connections for the nexus controller are shown in the table above. The REM (Remote Exit (release) Monitor) should be wired to the normally open contacts of the Remote release button. The Door monitor input should be connected to a normally closed, door contact. The default connections will provide 3 second door operation on REM or card with 20 second 'door open' alarm. These timings and programs are not fixed and can be changed via Visikey administration software to suit the installation.

NEXUS Modular Access Control

Readers and Reader Interface Operation

With all four DRM's connected, Nexus has 8 independent reader inputs. Each reader interface can connect to a reader and a number of differing reader technologies, although in the main there are four types of wired interface employed,

- Wiegand
- Watermark
- ABA Track 2
- PAC

This is not an exhaustive list and Morley is often asked to supply systems for site upgrades, where the adoption of existing cards and tokens is a requirement either as a permanent arrangement or as a temporary measure, as readers and tokens are exchanged. For details of other reader technologies available or to discuss the inclusion of another technology, please contact Morley Electronics.

Reader Interface Operation and Connection

As outlined above, Nexus has the ability to accept alternate reader types; the following information discusses the interface connections and their meaning.

Installers should note that reader cable shields should always be terminated to the Nexus controller back plate.

The DRM reader connection consists of six terminal inputs (on one block), where two are data lines, two LED outputs and power and ground, as illustrated in the diagram below.

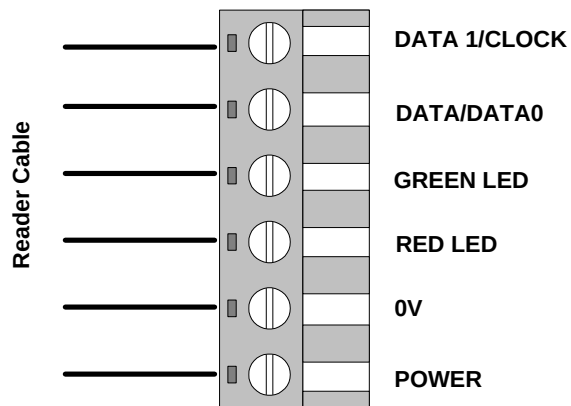


Fig. 15 Reader Input Functions

Each of these inputs relates to a specific reader interface connection dependent upon the reader technology to be used. The following table reviews the functionality of each of the inputs.

NEXUS Modular Access Control

Input connection 1.	Data1/Clock. This input interfaces to the clock or strobe line on Track 2 and Watermark readers. On Wiegand interfaces the Data 1 data output should be connected to this input.
Input connection 2.	Data/Data0 This input interfaces to the data line on Track 2 and Watermark readers. On Wiegand interfaces the data 0 output should be connected to this input. When using PAC readers this pin should be connected to the SIG output.
Input connection 3.	Green LED Open Collector output capable of sinking 50mA
Input connection 4.	Red LED Open Collector output capable of sinking 50mA
Input connection 5.	0V
Input connection 6.	Power This pin supplies power to the reader at both 5 and 12 volts. This output is protected with a 200mA thermal fuse. Once activated this fuse can only be reset by the removal of power to the auxiliary supply input. This Pin can supply both 12 and 5 volts @ 150mA. Readers requiring more current should be supplied via an alternative power source.

The reader interfaces will support most readers but if you are in any doubt as to the suitability of a reader, contact Morley Electronics Technical Support.

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Reader Voltage Selection

A reader voltage selector is located adjacent to each reader port and can be used to select between 12V and 5V reader supply voltages as shown in the diagram below.

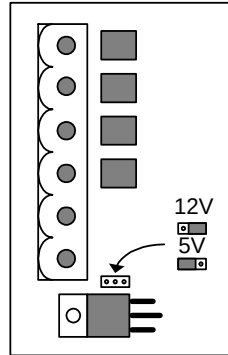


Fig. 16 Reader Voltage Selection

NOTE that the application of an incorrect supply voltage to a reader may cause permanent damage to the reader.

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Reader Connections in Nexus

The Nexus controller is, as described earlier, capable of supporting multiple card reader types concurrently. The following diagrams show wiring connections for the more common readers used with Nexus.

AceProx Readers

The AceProx range of readers use a standard Wiegand interface. All readers in the range are supported and should be wired as shown below. For further technical information refer to the reader installation manual.

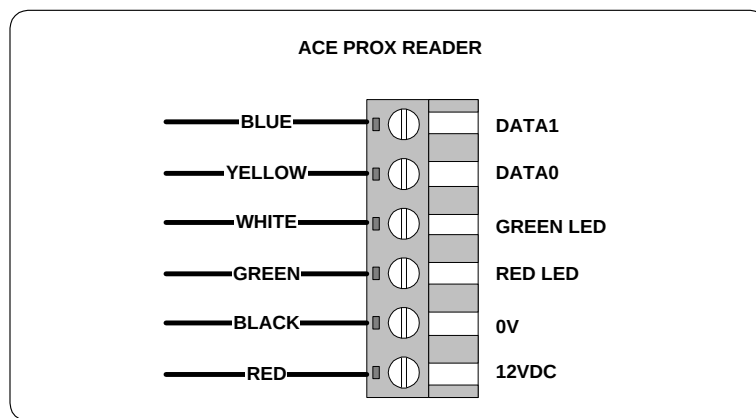
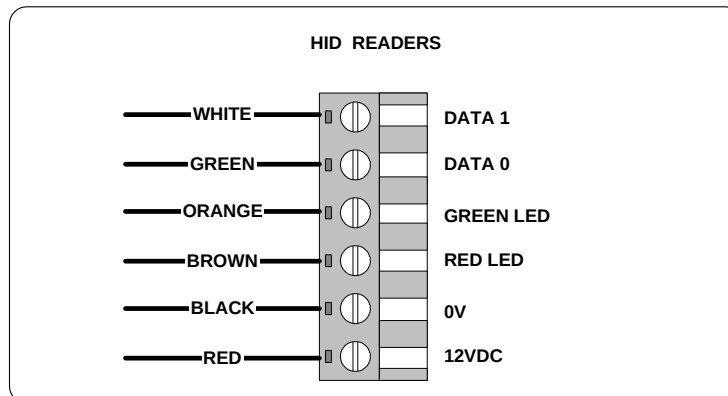


Fig. 17 AceProx Reader Connection

HID Proximity Readers

HID proximity readers are available with both Wiegand and track 2 interfaces, however readers from Morley are supplied with a Wiegand interface as standard. All readers in the HID range are fully supported by Nexus. The diagram below shows typical wiring for ProxPoint, MiniProx, ProxPro, and VandalProx and PanelProx readers. When installing other HID models, consult the installation manual for wiring and operational specifications.



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Fig. 18 HID Standard Reader Connection

Motorola/Indala Readers

Motorola and Indala proximity readers are available with both Wiegand and track 2 interfaces however these readers are supplied as standard with a Wiegand interface. All readers in the Motorola range are fully supported by Nexus. The diagram below shows typical wiring for Motorola two wire format readers. Note that Motorola readers are soft programmable and as such, allow the interface type and LED/Buzzer operation to be changed by the use of programming cards. When installing other Motorola models consult the installation manual for wiring and operational specifications.

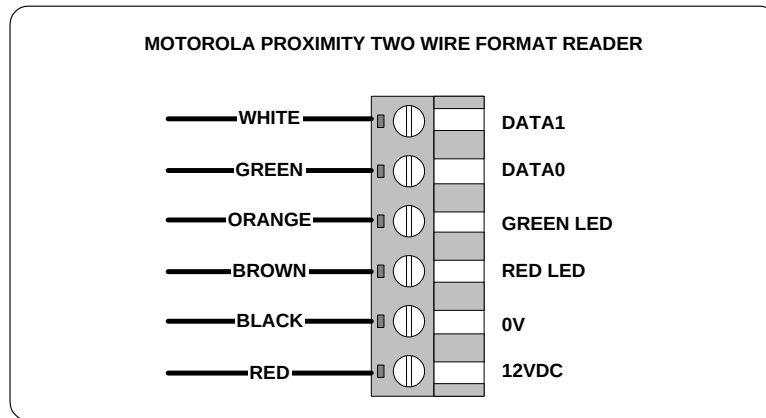


Fig. 19 Motorola Reader Connection

MR Sensors Readers

Nexus controllers support all MR Sensors Track 2 readers, however some keypad versions need modification for correct LED operation. We advise customers wishing to utilise card and keypad versions to contact Morley Electronics before purchasing readers. The diagram below shows standard interconnection wiring for a 5132B magstripe reader. For wiring and operational specifications, refer to the reader installation manual.

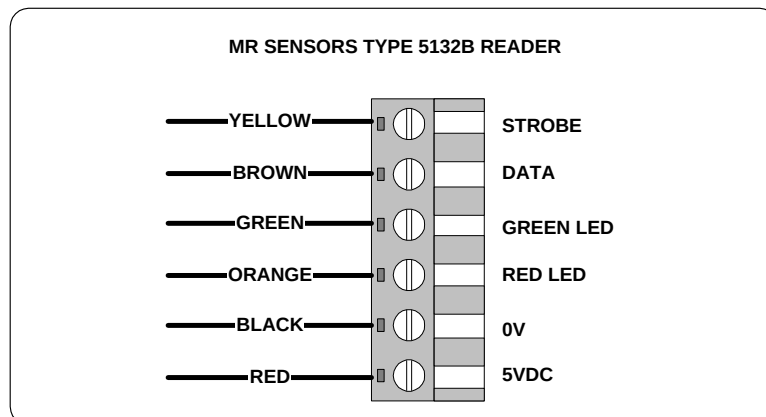


Fig. 20 MR Sensors Reader Connection

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PAC Proximity Readers

Nexus controllers supports the following PAC readers,

- EasiReader 20377/20387
- Standard Plus 20592/20593
- Slimline 20595/20596
- Vandal Resistant 20378/20388/20688/20683

To check the suitability of other readers in the PAC range please contact Morley technical support. Standard wiring interconnection for PAC readers is shown in the diagram below.

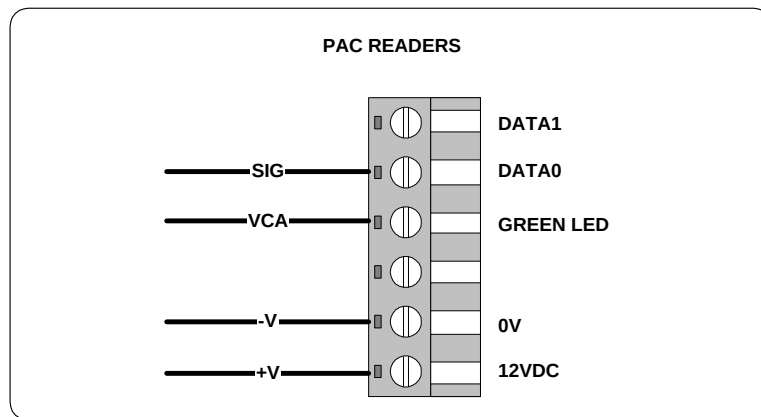


Fig. 21 PAC Reader Connection (see table for applicable PAC readers)

Watermark® Readers

Nexus supports both the old letterbox type Watermark readers and the new 1300SO readers. Standard interconnect wiring for Watermark readers is shown below.

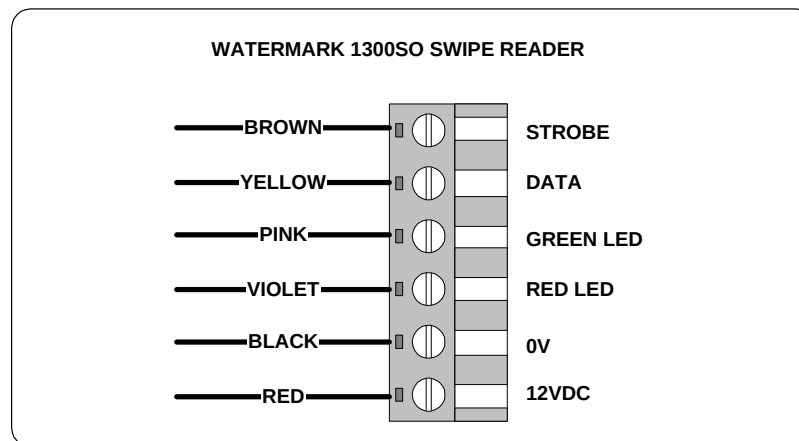


Fig. 22 Watermark Reader Connection

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RS422/485 Nexus/PC Network Interconnection

Part Number 104008

The RS232/485 converter is used to interface the administration PC RS232 serial port to the first Nexus controller RS485 Comms module. Why do we do it this way? Because it is much easier to enter the PC through the serial port than to attempt to install an RS485 PC board into the computer – which incidentally, may cause warranty invalidity issues with the PC supplier.

The converter has been chosen for its reliability and continued operation. Part number 104008 includes all elements necessary to interface communications and comprises the constituent parts described below.

Unpacking

After removing the 4 retaining screws from the enclosure, check the following parts are present

- 1 x Westermo MD-45 Converter (Din Rail Mounted)
- 1 x Serial Lead (female 9 way D Plug to 3 flying leads)
- 2 x Termination Resistors 120 ohm
- 5 x Cable ties
- 5 x Cable tie mounting eyelets
- 5 x Self-tapping screws
- 1 x Instruction/Specification Manual

Cable Installation

It is recommended that BELDEN 8723 or an equivalent cable type be used for the Nexus inter-controller connections. Each RS485 Nexus network can be a total network length of 1,200 m and, as mentioned earlier in this manual, up to 4 x RS485 networks can be installed on each PC. The following diagram re-visits the Nexus network structure.

Installers should always remember to link cable shields together within the RS485 comms modules. The shields 'float' between modules.

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Installers should note that the comms network must be wired in a DAISY - CHAIN TOPOLOGY AND MUST NOT BE SPURRED.

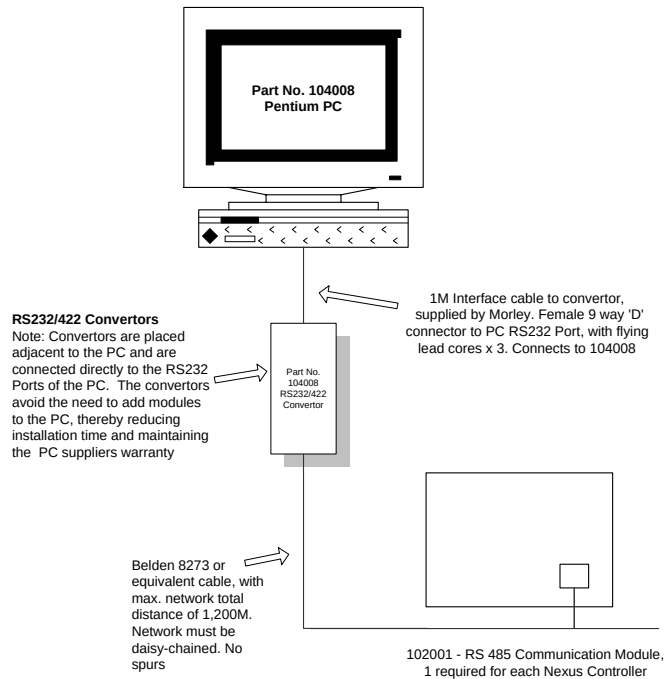


Fig. 23 RS232/485 Converter & Housing Schematic Diagram

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RS232/485 (MD-45) Converter Connections

RS232 Connection From PC to Converter

The serial lead provided with part no. 104008 is plugged into the Serial Port 'COM 1' at the rear of the PC.

Connections from the PC to the Converter are indicated below.

9 Way Screw Terminal Connector
on MD-45 converter

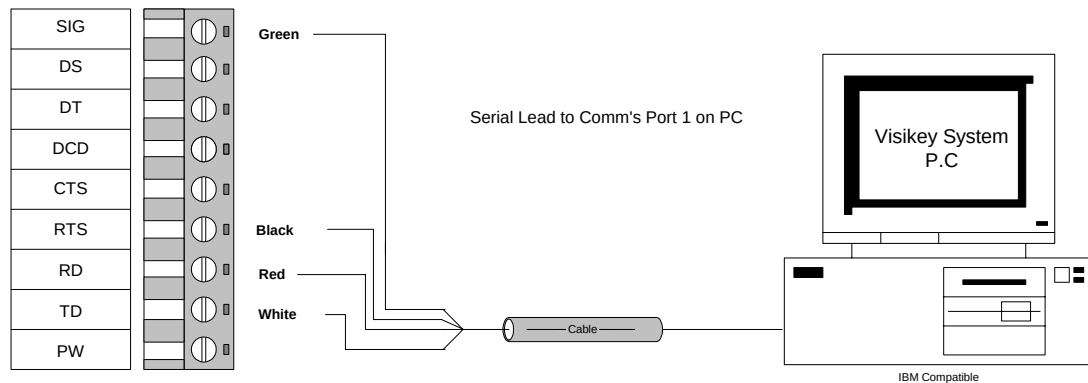


Fig. 24 Connection diagram, RS232/485 converter to PC

Fitting Communications Modules in Nexus

Nexus 485 communications modules are dispatched with fixing screws, a network cabling (9-pin) female connectors and a ribbon cable with fitted plug-in terminal strip.

Comms modules have 4 threaded screw fixing points, which are used to attach the module to the Nexus processor module. Ensure that all fixing screws are used.

The cable ribbon is fitted to the Nexus processor module through a slot immediately beneath the comms module fixings. Insert the cable ribbon terminal socket (it only fits one way) and press down, gently pushing at the edges, to firmly fit the socket to the board.

The comms module male cable connector should be made off and pushed to the female socket of the comms module to terminate the network to the 485 comms module.

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RS422 Line Connection

The RS422 Line connection from the converter to the Morley 485 Interface module is as follows: -

At the converter,

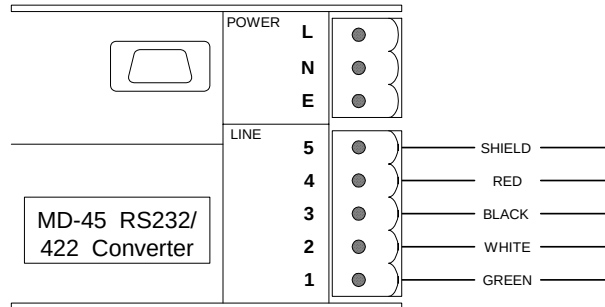


Fig. 25 RS232/485 Converter Connections

And at the RS485 comms interface module,

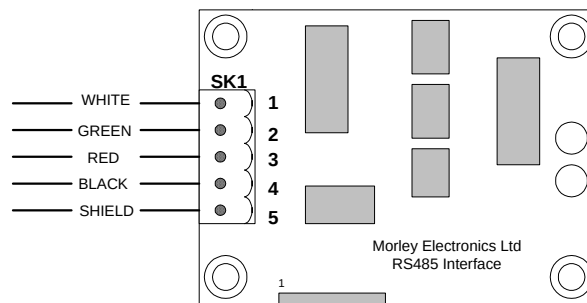


Fig. 26 RS232/485 485 Module Connections

Network Termination

The converter provides 4-wire termination at the network source, i.e. the converter. However it is still necessary to provide a network termination at the last controller on the network. This is achieved by inserting the two 120 ohm resistors provided between Pins 1 & 2 and between 3 & 4 on SK1 of the Morley RS485 Interface PCB at the last controller on the network.

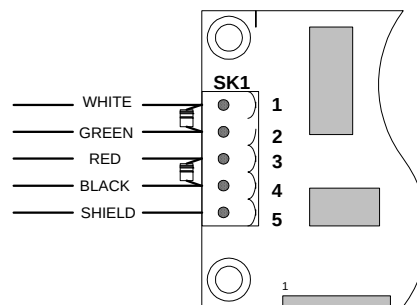


Fig. 27 RS485 Module Termination Connections

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Nexus RS485 Network Cable Testing

Before powering up the installation, use a multi-meter to carry out the following tests: -

With your meter set to resistance measure between Pins 1 & 2 on the RS485 module, this should yield a value of about 60 ohms.

With your meter set to resistance measure between Pins 3 & 4 on the RS485 module, this should yield a value of about 120 ohms.

Finally check for high impedance between the two pairs and between each pair and ground.

Configuration of PC COM Port in Visikey Software

Visikey should be active at this stage.

As with all Nexus/Visikey installations, the configuration of the system including the mapping of ports, is best carried out through Visikey Express Install feature (within Visikey). If this method is used, then all port mapping and configuration to the PC is carried out automatically.

However, if an additional controller is being added, express install is not the menu to help you, it will just re-install the software and re-set your configuration at the same time. In such instances, configure the port manually via the 'Config' and then 'Com port I/O' menus in Visikey software, i.e.

Once in the menu, set the Com Port as follows (for COM 1)

Configuration = COM 1 (0 x 03F8) IRQ 4

If you are unsure about setting up ports or would like further advice, feel free to contact Morley Electronics

Fitting Echelon Transceivers and Networks

The installation and fitting of Echelon networks and transceivers is a specialist task, which should be carried out in conjunction with Morley Technical Support. For details of Echelon networks and cabling, please see the Echelon network overview earlier in this manual, or contact Morley Electronics.

NEXUS Modular Access Control

Applying Power

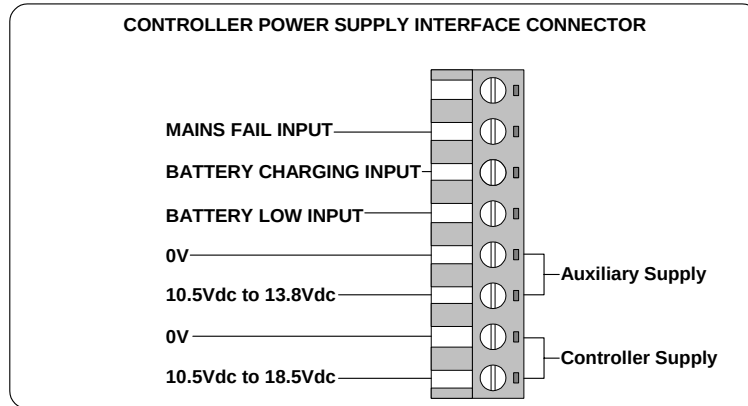


Fig. 28 Nexus Power Input

The controller has two power supply inputs, which are for the controller and an auxiliary supply. The controller supply provides power for controller logic and has a quiescent load of approximately 1.5W. This can be supplied from an unregulated power supply or connected in parallel with the auxiliary power supply. The Auxiliary power supply provides power for relays and readers.

When power is applied to the controller the green power LED located on the controller board illuminates and the yellow run LED flashes at one-second intervals to indicate correct operation of the Nexus micro controller.

Nexus does not carry an on-board power supply and is therefore reliant upon outside power to provide the necessary supply. Morley recommends that a (Part No. 109002) 1.5A psu be purchased for each Nexus controller. This rating is enough to power a fully loaded (i.e. 8 reader) Nexus controller. Note however, that this rating assumes standard readers and does not include power for locks. Should non-standard readers – long range for instance, be considered, the appropriate increase in quiescent and full load power requirements be estimated and a higher rated power supply be provided.

Accurately assessing the power requirements for any electrical system is a fundamental requirement to assure correct, safe and reliable operation of the system. To help installers reach this objective, the following power supply notes outline methods to accurately assess power needs.

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Please remember that changes in the system layout, in door and lock types and in reader selection, can all alter the original power requirements.

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Calculating Power Requirements

The following equation should be used for calculating the Auxiliary power supply requirements: -

$$AL = (RL \times 0.035) + (RC \times NR)$$

Where AL = Auxiliary Load
 RL = Number of Relays Fitted
 NR = Number of Readers fitted
 RC = Reader Current

If the calculation above is unclear, the following calculation notes and examples may help establish the power computation detail.

Power Supply Current Requirement Example 1 Typical Four-Door System (Read-in only)

For a typical four-door Nexus system we would need,

- 1 Nexus controller Part no. 101007
- DRM's, each having 4 relays and 2 readers connected Part no. 101008
- Using for example, HID MiniProx readers, which require 50mA per reader Part no. 105001

Therefore we have in total:

1 Nexus Controller
 8 Relays
 4 Readers

For the total PSU current loading we need to add the auxiliary current (I^{AUX}) to the controller current (I^{CTRL}).

Calculating The Auxiliary Current (I^{AUX})

The auxiliary current (I^{AUX}) is the current required to drive the relays and the readers.

Each relay requires 35mA and we have 8 of them.

Each reader requires 50mA and we have 4 of them.

So,

$$\begin{aligned} I^{AUX} &= (8 \times 35\text{mA}) + (4 \times 50\text{mA}) \\ &= (8 \times 0.035\text{A}) + (4 \times 0.050\text{A}) \\ &= 0.28\text{A} + 0.2\text{A} \\ &= 0.48\text{A} \end{aligned}$$

So, 0.48A is required just to power the relays and the readers.

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Calculating The Controller Current (I^{CTRL})

The controller current (I^{CTRL}) is the current required to drive a controller without any DRM's present.

The Controller quiescent current is 150mA

Therefore,

$$\begin{aligned} I^{CTRL} &= (1 \times 150\text{mA}) \\ &= (1 \times 0.15\text{A}) \\ &= 0.15\text{A} \end{aligned}$$

Total System Current

The total current (I^{TOTAL}) loading for this system is the auxiliary current (I^{AUX}) plus the controller current (I^{CTRL}).

Therefore:

$$\begin{aligned} I^{TOTAL} &= I^{AUX} + I^{CTRL} \\ &= 0.48\text{A} + 0.15\text{A} \\ &= 0.63\text{A} \end{aligned}$$

So, we would require a power supply capable of supplying at the very least 0.63A for this system.

NOTE:

THIS DOES NOT INCLUDE THE CURRENT REQUIREMENT FOR DOOR LOCKING MECHANISMS, WHICH SHOULD BE ESTIMATED SEPARATELY.

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Power Supply Current Requirement Example 2 2 X Nexus Controller System

Suppose we have,

- 2 Nexus controllers, one controller has 4 reader modules each having 8 relays and 2 readers connected
- The second controller has 1 reader module with 4 relays and 2 readers connected
- Using as before, HID MiniProx readers, which require 50mA per reader.

Therefore we have in total:

2 Nexus Controllers
36 Relays
10 Readers

For the total PSU current loading we need to add the auxiliary current (I^{AUX}) to the controller current (I^{CTRL}).

Calculating The Auxiliary Current (I^{AUX})

The auxiliary current (I^{AUX}) is the current required to drive the relays and the readers.

Each relay requires 35mA and we have 36 of them.

Each reader requires 50mA and we have 10 of them.

So,

$$\begin{aligned}
 I^{AUX} &= (36 \times 35\text{mA}) + (10 \times 50\text{mA}) \\
 &= (36 \times 0.035\text{A}) + (10 \times 0.050\text{A}) \\
 &= 1.26\text{A} + 0.5\text{A} \\
 &= 1.76\text{A}
 \end{aligned}$$

So, 1.76A is required just to power the relays and the readers.

NEXUS Modular Access Control

Calculating The Controller Current (I^{CTRL})

The controller current (I^{CTRL}) is the current required to drive a controller with no reader modules present.

Each Nexus controller requires 150mA.

Therefore,

$$\begin{aligned} I^{CTRL} &= (2 \times 150\text{mA}) \\ &= (2 \times 0.15\text{A}) \\ &= 0.3\text{A} \end{aligned}$$

Total System Current

The total current (I^{TOTAL}) loading for this system is the auxiliary current (I^{AUX}) plus the controller current (I^{CTRL}).

Therefore:

$$\begin{aligned} I^{TOTAL} &= I^{AUX} + I^{CTRL} \\ &= 1.76\text{A} + 0.3\text{A} \\ &= 2.96\text{A} \end{aligned}$$

So, we would require a power supply capable of supplying at the very least 2.96A for this system.

NOTE:

THIS DOES NOT INCLUDE THE POWER REQUIREMENT FOR DOOR LOCKING MECHANISMS, WHICH SHOULD BE CALCULATED SEPARATELY.

NEXUS Modular Access Control

Specifications

Controller

Controller Power Supply
Auxiliary Power Supply

10.5Vdc – 18Vdc 150mA
10.5Vdc – 18Vdc 3A MAX (Configuration
Dependent)

Temperature
Humidity
Dimensions
Weight

0°C to 40°C
0-80% RH, non-condensing
W 380mm x H 370mm D 70mm
6Kg, fully loaded Nexus c/w 4 x DRM

RS232/422 Networks

Cable Type
Maximum N/work Length
Network Topology

Belden 8723 or Equivalent
1200m maximum
Daisy Chain

Echelon ® Networks

FTT Network Length
Bus Network Length

500m Maximum
2700m Maximum (Doubly terminated)

Standard Modules

Reader interfaces
Supported interfaces

2 per module
Watermark
Wiegand
ABA track2
PAC
20 AWG 125m Maximum (std readers)
4 or 8 clean contact monitors
20 AWG 250m Maximum
4 or 8 change over contacts
4A @ 12v or 24v

Reader Cable
Monitored Inputs
CCM cable
Relay Outputs
Relay Switching current

NEXUS Modular Access Control

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